The JPL Aircraft Topographic Synthetic Aperture Radar (TOPSAR) System for Rapid Production of DEM's

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We have developed an aircraft radar interferometer, TOPSAR, that uses a synthetic aperture radar and interferometry to rapidly produce topographic maps of the earth. In some applications, this radar technique has the potential of replacing traditional photogrammetry which uses aerial photography. In other applications, radars can map areas inaccessible to aerial photography because of darkness or weather.

We operate a C-band (6 cm wavelength) radar interferometer as an adjunct to the JPL Aircraft Synthetic Aperture Radar (AIRSAR) system that routinely acquires multi-polarization SAR images at P-band (70 cm wavelength), at L-band (25 cm wavelength) and at C-band. The TOPSAR/AIRSAR system flies on the DC-8 Airborne Laboratory operated by the NASA Ames Research Center. The TOPSAR system is implemented via two antennas mounted nearly vertically on the left side of the DC-8 aircraft with a 2.6 meter baseline spacing. Interferometric maps of the surface are constructed by comparing the phase differences between SAR images from the two antennas. Statistical elevation errors for the TOPSAR system range from 1.0 meters for flat land to 3.0 meters for mountainous areas. Lateral resolution is 5-10 meters.

Typical data acquisitions are for areas of 10 km across-track (i.e. in range) and up to 50 km along track (i.e. in azimuth), Radar data obtained in the Galapagos Islands (Islas Fernandina and Isabella) demonstrated that these 10 km-by-50 km topographic maps could be mosaicked together for an area of about 50 km-by-50 km.

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